



THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Patent Application of:
David Garrett

Serial No.: 10/804,411

Filed: March 19, 2004

Title: Method Of Sphere Decoding With Low
Complexity And Good Statistical Output

: Group Art Unit: 2611

: Examiner: Jason M. Perilla

: Dated: January 04, 2010

TO: HONORABLE COMMISSIONER FOR PATENTS
ALEXANDRIA, VA 22313

BRIEF OF APPELLANT

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BRIEF OF APPELLANT

This is an appeal from the final Rejection of the Examiner dated June 01, 2009 rejecting all claims. The requisite fees set forth in Section 1.17 of the Regulations accompany this Brief.

REAL PARTY IN INTEREST

The application is assigned to Lucent Technologies, Inc.

RELATED APPEALS AND INTERFERENCES

Neither the Appellant nor its legal representative is aware of any prior or pending appeals, interferences or judicial proceedings that may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

This application was filed as an original application on March 19, 2004, containing one claim, independent claim 1. By Preliminary Amendment dated June 8, 2004, the Applicant added dependent claims 2 and 3.

In an Office Action dated July 19, 2007, claims 1-3 were rejected under 35 USC §103(a) as being unpatentable over Davis *et al.* (U.S. Pub. No. 2004/0181419) in view of Garrett (U.S. Pub. No. 2004/0042565) and further in view of Chan *et al.* (“A Simple Taboo-Based Soft Decision Decoding Algorithm For Expander Codes,” IEEE Communications Letters, Vol. 2, No. 7, pp. 183-185, July 1998).

Applicant sought reconsideration of that rejection by a Response filed on November 19, 2007, which argued that the primary reference was not prior art to the invention, being the inventors own work, published after the filing date of the instant application, and both the reference and the application being commonly assigned to Lucent Technologies. The Applicant also argued lack of motivation to combine the teaching of the cited references. No claims were amended.

In the next Office Action dated December 27, 2007, which was a non-final action, claims 1-3 were again rejected under 35 USC §103(a) as being unpatentable over Lei *et al.* (“Reduced Complexity Maximum Likelihood Detection For V-BLAST Systems,” IEEE Military Communications Conference, 2003 MILCOM, Vol. 2, pp. 1386-1391, Oct. 2003) in view of Garrett (U.S. Pub. No. 2004/0042565) and further in view of Chan *et al.* (“A Simple Taboo-Based Soft Decision Decoding Algorithm For Expander Codes,” IEEE Communications Letters, Vol. 2, No. 7, pp. 183-185, July 1998).

In a response filed June 27, 2008, the Applicant amended the Application to claim priority from an earlier-filed application of the same inventor (the cited 0042565 reference), which was co-pending at the time of filing the instant application, accompanied by a Petition For Acceptance Of Unintentionally Delayed Claim For Benefit Of Prior-Filed Application (along with requisite fees), which petition was granted on September 16, 2008 by the Office Of

Petitions. Based on the effective removal of the cited Garrett reference due to this amendment, the Applicant again argued that the §103 rejection could not stand, and again sought reconsideration. No claims were amended.

In the next Office Action dated November 18, 2008, which was a non-final action, claims 1-3 were rejected under 35 USC §103(a) as being unpatentable over *Lei et al.* (“Reduced Complexity Maximum Likelihood Detection For V-BLAST Systems,” IEEE Military Communications Conference, 2003 MILCOM, Vol. 2, pp. 1386-1391, Oct. 2003) in view of *Yakhnich et al.* (U.S. Pub. No. 2002/0122510) and further in view of *Chan et al.* (“A Simple Taboo-Based Soft Decision Decoding Algorithm For Expander Codes,” IEEE Communications Letters, Vol. 2, No. 7, pp. 183-185, July 1998).

In a response filed April 20, 2009, the Applicant argued that no reasonable combination of the cited art could be made to teach the limitations of independent claim 1, and again sought reconsideration. No claims were amended.

In the next Office Action dated June 01, 2009, which was a final action, the §103 art rejections of the previous action were maintained as to all claims (claims 1-3).

On September 1, 2009 the Applicant filed a Notice of Appeal herein in response to the June 1, 2009 Final Office Action.

The status of claims as set out in the June 1, 2009 Final Office Action was, and is as follows:

Allowed Claims: None

Claims Rejected, andAppealed herein: 1-3.

STATUS OF AMENDMENTS

No claim amendments were filed subsequent to the final rejection. Originally filed claim 1 and dependent claims 2-3 filed by the June 8, 2004 Preliminary Amendment have been entered and the claims in the case are set out in Appendix A.

SUMMARY OF CLAIMED SUBJECT MATTER

The invention claimed here is directed to an improved method for authenticating an email message as having actually been sent from the sender indicated in the From field of such a message/

Independent claim 1 is each directed to a method for decoding a received vector symbol corresponding to a binary string having a plurality of bit positions and incorporating the following features:

(1) performing a sphere search so as to obtain an initial set of candidate vectors including a most likely candidate vector; [Specification, p. 9, lines 3-15; Figure 5, steps 140, 150, 160] and

(2) computing a log-likelihood ratio for each of said bit positions, wherein each said ratio is based on values of a cost function computed for at least some candidate vectors belonging to the initial set, and on values of the cost function for at least some further candidate vectors constructed by flipping one or more bits of the most likely candidate vector. [Specification, p. 9, lines 15-28; Figure 5, steps 170, 180]

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner has rejected all of Applicants' claims under 35 U.S.C. §103(a), on the ground that the claimed invention is unpatentable over a combination of three references -- Lei *et al.* ("Reduced Complexity Maximum Likelihood Detection For V-BLAST Systems," IEEE

Military Communications Conference, 2003 MILCOM, Vol. 2, pp. 1386-1391, Oct. 2003); Yakhnich *et al.* (U.S. Pub. No. 2002/0122510); and Chan *et al.* ("A Simple Taboo-Based Soft Decision Decoding Algorithm For Expander Codes," IEEE Communications Letters, Vol. 2, No. 7, pp. 183-185, July 1998).. It is the Appellant's position that no reasonable combination of the cited references show or suggest the limitations of the claimed invention. Accordingly, the issue for review in this appeal is that of whether the references cited by the Examiner support his §103 rejection basis.

ARGUMENT

In the Final Office Action, claims 1-3 were rejected under 35 USC §103(a) as being unpatentable over Lei *et al.* ("Reduced Complexity Maximum Likelihood Detection For V-BLAST Systems," IEEE Military Communications Conference, 2003 MILCOM, Vol. 2, pp. 1386-1391, Oct. 2003) in view of Yakhnich *et al.* (U.S. Pub. No. 2002/0122510) and further in view of Chan *et al.* ("A Simple Taboo-Based Soft Decision Decoding Algorithm For Expander Codes," IEEE Communications Letters, Vol. 2, No. 7, pp. 183-185, July 1998). The Applicant respectfully submits that no supportable combination of the cited art teaches or suggests the combination of features of the invention which appear as limitations in independent claim 1, and therefore that the §103 rejection cannot be sustained.

In the application here, the inventor has disclosed and claimed an improved method of spherical decoding for reducing the complexity of maximum likelihood decoding of composite signals received from a transmitter using multiple transmit antennas. As is known, such spherical decoders produce a series of candidate strings representing bits or symbols of the received data, with a cost function applied to the candidate strings for selecting the most likely candidate string corresponding to the received data. The Applicant points out in his

Specification that a known method for applying such spherical decoding is carried out by progressively reducing the sphere search radius as candidate strings are determined and evaluated. However, as the Applicant also points out, as the search radius is reduced, the quality of the data provided by the spherical search process tends to be impaired. To address that problem, the invention operates to increase the number of candidate strings available for evaluation at a search radius by combining the set of candidate strings determined at that radius with an additional set of candidate strings constructed to be probabilistically useful to the decoding process. According to the invention, such an additional set of candidate strings is constructed by flipping one or more bits of the most likely candidate string.

With respect to the art cited against the Applicant's claims, the primary reference, Lei, teaches no more than the basic idea of using a spherical decoder to implement reduced complexity maximum likelihood detection for signals transmitted in a multiple antenna transmission environment, a teaching Applicant also acknowledged in his Specification as being known in the art. Moreover, as acknowledged in the Office Action, Lei fails to teach either the features of Applicant's invention of (1) computation of log-likelihood ratios for bit positions determined from the spherical decoding or (2) the use of a cost function based on candidate vectors constructed by flipping one or more bits of the most likely candidate vector, both of which features are included as limitations in the present claims.

The Office Action cites the Yakhnich reference as teaching the limitation of computing a log-likelihood ratio for the bit positions of a received candidate vector determined in the spherical decoding step. While the Applicant acknowledges that the cited portion of Yakhnich provides a general teaching of applying log-likelihood ratios to symbol bit positions, it is noted that the Applicant has already described in his Specification such a general application of log-

likelihood ratios to symbol bit positions as generally known in the prior art, and it is respectfully submitted that the teaching of Yakhnich adds nothing to that prior description of the current art.

With respect to the Chan reference, the Applicant respectfully submits that the only similarity between the teaching of that reference and the invention taught and claimed here is the use of the term “bit flipping” in the Chan abstract. The “bit flipping” of Chan is uniquely applied to error correction for Simple Parity Check (SPC) coding. Specifically, according to Chan, flipping the value (i.e., changing to the complimentary value) of a variable in a block of SPC coded data has the effect of flipping the “satisfied” and “unsatisfied” constraints for the variables within the block. This property is then used by Chan to selectively flip particular block variables for identifying erroneous variables in the block.

Applicant respectfully submits that Chan’s teaching of complementing a variable value in blocks of SPC coded data cannot reasonably be construed as showing or suggesting the limitation of Applicant’s claims directed to the feature of increasing the number of candidate strings available for analysis at a given radius in a spherical decoder, where the additional candidate strings are constructed by flipping one or more bits of the most likely candidate vector.

Moreover, it is respectfully submitted that, even if the disparate cited references were construed to teach each of the relevant components of the invention here – and Applicant strongly contests that such a construction is possible, there has been no showing of a motivation to combine those references in the manner of the invention here. Indeed, there is no recognition whatsoever in those references of the problem addressed by the invention of the present application. Thus, the rejection here becomes a classic “hindsight” rejection -- *using the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention* – an approach consistently rejected by the courts. See *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998):

Virtually all inventions are combinations of old elements [*citations omitted*]. Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be an illogical and inappropriate process by which to determine patentability.

To prevent the use of hindsight based on the invention to defeat patentability out the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge out of claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. [*In re Rouffet. id.*]

Appellant therefore respectfully requests that the Board reverse the Examiner on the issue of whether Applicant's claimed invention is patentable over the references cited by the Examiner, and that it thereupon direct the allowance of the present application.

Respectfully submitted,



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Dated: January 04, 2010

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APPENDIX I
CLAIMS IN CASE

The Claims

1. **(Original)** A method for decoding a received vector symbol which corresponds to a binary string having a plurality of bit positions, comprising:
 - (a) performing a sphere search so as to obtain an initial set of candidate vectors including a most likely candidate vector; and
 - 5 (b) computing a log-likelihood ratio for each of said bit positions, wherein each said ratio is based on values of a cost function computed for at least some candidate vectors belonging to the initial set, and on values of the cost function for at least some further candidate vectors constructed by flipping one or more bits of the most likely candidate vector.
2. **(Previously Presented)** The method of claim 1, further comprising including in the initial set of candidate vectors at least one vector that has been excluded by the sphere search as lying outside a search radius.
3. **(Previously Presented)** The method of claim 1, wherein each of the at least some further candidate vectors is constructed by flipping precisely one bit of the most likely candidate vector.

APPENDIX II

Evidence Appendix

Not Applicable

APPENDIX III

Related Proceedings Appendix

Not Applicable